Atty. Dkt. No. 200311961-1

REMARKS

Claims 1-27 were pending. Claims 1-27 were rejected. This response amends none of the claims. Claims 1-27 are pending. The Applicant hereby requests further consideration and re-examination in view of the amendments made above and remarks set forth below.

Specification Amendments:

The related applications section has been amended to replace the parenthetical references to attorney docket numbers with the patent application numbers of related applications.

The detailed description has been amended to correct typographical errors of a "second step 204" and a "third step 206" with a "third step 206" and a "fourth step 208," respectively. Comparing flow diagram blocks 206 and 208 of figure 2 with the originally filed paragraphs shows that the language of the paragraphs refers to these blocks, respectively. Also, a "second step 204" is discussed earlier in the application and block 206 is preceded by two blocks in figure 2.

The detailed description has been amended to include a reference to step 712 found in figure 7 in two paragraphs. By the context of the discussion of the amended paragraphs and the step 712 of figure 7, step 712 is a "sixth step 712" which may choose "the improvement technique" identified within the decision block 712 and which is mentioned in numerous places near both of the two amended paragraphs and in the second of the two amended paragraphs.

The detailed description has been amended to correct a typographical error which misidentified a method as "method 600," when from the context the reference is clearly to "method 700."

No new matter has been added by these amendments to the specification.

Claim Rejections under 35 U.S.C. § 102:

Claims 1-5, 11-14, and 24-27 were rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 6,374,227 to Ye. The rejection is respectfully traversed.

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Claim 1:

Claim 1 was rejected as anticipated by U.S. Patent No. 6,374,227 to Ye, which is respectfully traversed.

Claim 1 claims a method of selecting a heuristic class for data placement in a distributed storage system. An integer program is formed for each of a plurality of heuristic classes. Each of the integer programs comprises an objective of minimizing a replication cost. Each of the integer programs is solved, which provides the replication cost for each of the heuristic classes. The heuristic class having a low replication cost is selected.

The Office Action rejection of claim 1 is incorrect in many respects. The Office Action refers to Ye's abstract at lines 1 and 12-14 as teaching "*selecting a heuristic class for data placement in a distributed storage system,*" which is incorrect for at least four reasons. Ye's abstract states:

> A system (8) for optimizing the allocation of a resource includes an optimizer file (14) containing resource allocation data including a demand for allocation of the resource, a plurality of bids for the resource, and a plurality of reserve bids for the resource. A solver (18) receives an integer program and generates an LP relaxation solution to the integer program. An optimizer engine (16) coupled to the file (14) and to the solver (18) receives the data and the LP relaxation solution and generates an enhanced integer program that includes at least one cut according to the data. The cut includes a lifted cover inequality of a specified general form that the LP relaxation solution violates. A specified parameter associated with the lifted cover inequality is determined according to a first heuristic. The solver (18) generates a solution to the enhanced integer program that optimizes the allocation of the resource subject to the demand, bids, and reserve bids. In another embodiment, the engine (16) constructs a maximization problem of a specified general form according to the data, bids, and reserve bids and communicates the problem. The problem incorporates a special ordered set. The solver (18) receives the problem and determines a cover according to the problem.

First and second, Ye teaches nothing about a *heuristic class* nor *selecting a heuristic class*. Instead, Ye teaches using a heuristic (i.e., the "first heuristic") to determine a specified parameter. Third and fourth, Ye teaches nothing about *selecting a heuristic class for data placement* and nothing about *selecting a heuristic class for data placement in a distributed storage system*. Instead, Ye teaches optimizing the allocation of a resource.

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Further, the Office Action refers to Ye's abstract at lines 4-6 as teaching "*forming an integer program for each of a plurality of heuristic classes*," which is incorrect. Ye's abstract (see above) does not teach "*forming an integer program for each of a plurality of heuristic classes.*" Rather, Ye teaches receiving an integer program that, as taught elsewhere in Ye, is to be solved to optimize the allocation of the resource (e.g., see Ye at col. 2, line 60, to col. 3, line 13, and col. 5, lines 20-22).

Further, the Office Action refers to Ye's abstract at lines 14-17 as teaching "*each of the integer programs comprising an objective of minimizing a replication cost*," which is incorrect. Ye's abstract (see above) teaches nothing about "*a replication cost.*" Ye teaches nothing about *minimizing a replication cost*. Ye teaches nothing about *an objective of minimizing a replication cost*. And Ye teaches nothing about an *integer program... comprising an objective of minimizing a replication cost*. Rather, Ye teaches an integer program that optimizes the allocation of a resource subject to the demand, bids, and reserve bids.

Further, the Office Action refers to Ye's abstract at lines 6-7 and 17-22 as teaching "*solving each of the integer programs which provide the replication cost for each of the heuristic classes*," which is incorrect. Ye's abstract (see above) teaches nothing about a *heuristic class* nor *heuristic classes*. Ye teaches nothing about a *replication cost for each of the heuristic classes*. Ye teaches nothing about *solving each of the integer programs which provide the replication cost for each of the heuristic classes*. Rather, Ye teaches that an integer program may be a maximization problem.

Further, the Office Action refers to Ye's abstract at lines 7-10 as teaching "*selecting the heuristic class having a low replication cost*," which is incorrect. Ye's abstract (see above) teaches nothing about a *heuristic class*. Ye teaches nothing about *a low replication cost*. Ye teaches nothing about a *heuristic class having a low replication cost*. And, Ye teaches nothing about *selecting the heuristic class having a low replication cost*. Instead, Ye teaches receiving an LP relaxation solution of an integer program and generating an enhanced integer program that includes at least one cut according to the data.

To anticipate a claim, a prior art reference must teach each and every limitation of the claim. Not only does Ye not teach each and every limitation of claim 1, Ye fails to

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teach many of the limitations of claim 1. Accordingly, Claim 1 is allowable and an early allowance would be greatly appreciated.

Claim 2:

Claim 2 was rejected as anticipated by U.S. Patent No. 6,374,227 to Ye, which is respectfully traversed.

Claim 2 claims a method of selecting a heuristic class for data placement in a distributed storage system. A general integer program, which models the data placement, is formed. A specific integer program, which models a heuristic class for the data placement, is formed. The general and specific integer programs each comprise an objective of minimizing a replication cost. The general integer program is solved, which provides a general lower bound for the replication cost. The specific integer program is solved, which provides a specific lower bound for the replication cost. The heuristic is selected if a difference between the general lower bound and the specific lower bound is within an allowable amount.

The Office Action rejection of claim 2 is incorrect in many respects. The Office Action refers to Ye's abstract at lines 1 and 12-14 as teaching "*selecting a heuristic class for data placement in a distributed storage system,*" which is incorrect for the at least four reasons discussed above relative to claim 1.

The Office Action refers to Ye at col. 21, line 67, to col. 22, line 1, as teaching "*forming a general integer program which models the data placement,*" which is incorrect. Ye at col. 21, line 65, to col. 22, line 2, states: "Optimizer engine 16 accesses some or all of the resource allocation data stored in the file 14 at step 104 and constructs a standard integer program according to the data reflecting the optimization problem being addressed at step 106." Ye does not teach modeling *data placement*. Ye does not teach *forming [an] integer program which models the data placement*. Rather, Ye teaches accessing resource allocation data and forming an integer program according to the resource allocation data that reflects the optimization problem being addressed.

The Office Action refers to Ye at col. 22, lines 42-46, and col. 23, lines 6-7, as teaching "*forming a specific integer program which models a heuristic class for the data placement,*" which is incorrect. Ye at col. 22, lines 42-46, and col. 23, lines 6-9, states:

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> If one or more suitable cuts have been generated at step 210, then optimizer engine 16 incorporates the cuts into the integer program to generate an enhanced integer program, and the process returns to step 200... In one embodiment, optimizer engine 16 applies the first heuristic step 308 to attempt to determine the lifting coefficients (α - 1 needed to lift the cover C and generate a corresponding lifted cover inequality.

Ye does not teach *a heuristic class for the data placement*. Ye does not teach *forming a specific integer program which models a heuristic class for the data placement*. Rather, Ye teaches incorporating cuts into an integer program, which generates an enhanced integer program, and applying a heuristic (i.e., the "first heuristic") to attempt to determine lifting coefficients.

The Office Action refers to Ye at col. 17, lines 40-53, as teaching, "*the general and specific integer programs each comprise an objective of minimizing a replication cost*," which is incorrect. Ye at col. 17, lines 22-53, gives an example of a cutting process that is performed by an optimizer relative to a demand constraint (line 32). The demand constraint includes binary variables that correspond to carrier bids and a continuous variable that corresponds to a carrier reserve bid. Each of the bids has a unit price P[b]. As taught at col. 17, lines 48-53, "[o]ptimizer engine 16 generates at least two cuts in this example--a first cut in the form of a violated cover inequality strengthened according to a special ordered set and a second cut in the form of a violated lifted cover inequality--to prevent IP solver 18 from generating this fractional solution." Ye does not teach *a replication cost*. Ye does not teach *an objective of minimizing a replication cost*. Ye does not teach a *specific integer program... compris[ing] an objective of minimizing a replication cost*. And, Ye does not teach a *general integer program... compris[ing] an objective of minimizing a replication cost*. Instead, Ye teaches an example of a cutting process.

The Office Action refers to Ye at col. 7, lines 49-52, as teaching "*solving the general integer program which provides a general lower bound for the replication cost*," which is incorrect. Ye at col. 7, lines 49-52, states: "The LP relaxation solution provides a lower bound to the integer program solution that all real solutions to the optimization problem must equal or, as is more likely in typical scenarios, exceed." Ye does not teach a *replication cost*. Ye does not teach a *general lower bound for the replication cost*. And, Ye does not teach *solving[an] integer program which provides a general lower*

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bound for the replication cost. Rather, Ye teaches that a linear program relaxation solution of an integer program provides a lower bound for a solution of the integer program.

The Office Action refers to Ye at col. 9, lines 44-49 as teaching, "*solving the specific integer program which provides a specific lower bound for the replication cost,*" which is incorrect. Ye at col. 9, lines 44-49, states: "This cutting process also improves the lower bound that the LP relaxation solution provides, that is, cuts introduced according to the cutting process allow the LP relaxation solution for root node 32--the theoretical lower bound on the total shipping cost--to more closely approximate the optimal real solution." Ye does not teach a *replication cost.* Ye does not teach a *lower bound for the replication cost.* And, Ye does not teach *solving [an] integer program which provides a specific lower bound for the replication cost.*

The Office Action refers to Ye at col. 15, lines 50-64, as teaching, "*selecting the heuristic class if a difference between the general lower bound and the specific lower bound is within an allowable limit,*" which is incorrect. Ye at col. 15, lines 50-66, states:

> In some cases, no lifting may have resulted from optimizer engine 16 applying the first heuristic, such that all the lifting coefficients (α - 1) in the lifted cover inequality (8) are equal to zero. In one embodiment, if the coefficients of some or all the binary variables not in the cover C are larger then the coefficient of some or all the variables in the cover C, then it may be impossible to lift the variables in the cover C. As a result, an upper cutoff may exist above which no lifting is possible. For example, if A[b] is the largest coefficient for binary variables in the cover C, the upper cutoff is in general equal to A[b]+cλ, where $0 \leq c \leq 1$ and c is used to determine how large the lifting coefficient of x[b] may be. In general, a smaller c will result in a lower upper cutoff and larger lifting coefficients. Desirably, the upper cutoff is made as large as possible such that lifting is more likely.
>
> If no lifting results from optimizer engine 16 applying the first heuristic, ...

Ye does not teach a *heuristic class.* Ye does not teach *selecting the heuristic class if a difference between the general lower bound and the specific lower bound is within an allowable limit.* Rather, Ye teaches that an optimizer engine applies a heuristic (i.e., the "first heuristic") to determine lifting results.

To anticipate a claim, a prior art reference must teach each and every limitation of the claim. Not only does Ye not teach each and every limitation of claim 2, Ye fails to

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teach many of the limitations of claim 2. Accordingly, Claim 2 is allowable and an early allowance would be greatly appreciated.

Claims 3-5 and 11-14:

Claims 3-5 and 11-14 were rejected as anticipated by U.S. Patent No. 6,374,227 to Ye, which is respectfully traversed.

In the interest of brevity, the Office Action assertions regarding claims 3-5 and 11-14 are not being individually addressed here. Applicant also notes that many if not all of these assertions are incorrect. For example, with regards to claim 3, the Office Action refers to Ye at col. 6, line 67, to col. 7, line 2, for the proposition that Ye teaches, "*wherein inputs used in the steps of forming the general and specific integer programs comprise a system configuration*," which is incorrect. Ye at col. 6, line 67, to col. 7, line 2, refers to a computer used to solve an integer program, not a configuration of a computer or a computer system (i.e., a system configuration) that is an input to an integer program.

Rather, Applicant asserts that claims 3-5 and 11-14 are dependent upon independent claim 2. Dependent claims include all of the limitation of the claim upon which they depend. As explained above, claim 2 is not anticipated by Ye. Thus, claims 3-5 and 11-14 are also not anticipated by Ye. Accordingly, claims 3-5 and 11-14 are allowable and an early allowance would be greatly appreciated.

Claim 24:

Claim 24 was rejected as anticipated by U.S. Patent No. 6,374,227 to Ye, which is respectfully traversed.

Claim 24 claims a method of selecting a heuristic class for data placement in a distributed storage system. A general integer program, which models the data placement, is formed. Specific integer programs, which model a plurality of heuristic classes, are formed. The general and specific integer programs each comprise an objective of minimizing a replication cost. The general integer program is solved, which provides a lower bound for the replication cost. The specific integer programs are solved, which provides the replication cost for each of the heuristic classes. A particular heuristic class correlated to a low replication cost is selected if a difference between the lower bound and the low replication cost is within an allowable limit.

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The Office Action rejection of claim 24 is incorrect in many respects. The Office Action refers to Ye's abstract at lines 1 and 12-14 as teaching, "*selecting a heuristic class for data placement in a distributed storage system*," which is incorrect for the at least four reasons discussed above relative to claim 1.

The Office Action refers to Ye at col. 21, line 67, to col. 22, line 1, as teaching "*forming a general integer program which models the data placement*," which is incorrect for the reasons discussed above relative to claim 2.

The Office Action refers to Ye at col. 17, line 15, as teaching "*forming a plurality of specific integer programs which model a plurality of heuristic classes*," which is incorrect. Ye at col. 17, lines 4- 21 (including line 15 with underlining added here) states:

> For example, if the current cover C includes the awarded bids x[1] and x[2], corresponding to a solution that z[1]=z[2]=1, then in one embodiment an additional constraint might be that z[1]+z[2].ltoreq.1, making it impossible to have both z[1]=1 and z[2]=1 simultaneously. After incorporating an additional constraint, optimizer engine 16 reoptimizes using IP solver 18 to generate a new cover C, lifts the new cover C in the manner described above, and determines whether a suitable cut has been found. The procedure iterates in this manner until optimizer engine 16 finds an acceptable number of cuts, optimizer engine 16 incorporates these cuts into the integer program to generate one or more enhanced integer programs, and IP solver 18 generates an acceptable solution to at least one of the enhanced integer programs. Through the process of generating multiple covers C and applying multiple lifting approaches, optimizer engine 16 is in general able to generate many cuts that would otherwise be overlooked, which provides an important technical advantage.

Ye does not teach a *heuristic class*. Ye does not teach *a plurality of heuristic classes*. Ye does not teach *forming a plurality of specific integer programs which model a plurality of heuristic classes*. Instead, Ye teaches using a heuristic (i.e., the "first heuristic") to determine a specified parameter (Ye's abstract) and, more particularly, applying a heuristic (i.e., the "first heuristic") to attempt to determine lifting coefficients (Ye at col. 23, lines 6-7).

Applicant notes that, relative to the claim limitation of "*forming a plurality of specific integer programs which model a plurality of heuristic classes*," the Office Action draws the conclusion that the words "integer programs" in line 15 anticipate "*forming a*

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plurality of specific integer programs which model a plurality of heuristic classes" because as the Office Action states "integer programs ... inevitably model heuristic classes," which is incorrect. Integer programs may model many things. In fact, Ye teaches optimizing the allocation of a resource that is preferably shipping lanes (or alternatively parts in a manufacturing process or goods sold in a commercial establishment) and that such a shipping cost minimization problem may be modeled as an integer program (Ye at col. 2, line 60, to col. 3, line 13, and col. 5, lines 20-22). There is nothing in Ye about a *heuristic class*, *heuristic classes*, or *forming a plurality of specific integer programs which model a plurality of heuristic classes*.

The Office Action refers to Ye at col. 17, lines 40-53, as teaching "*the general and specific integer programs each comprising an objective of minimizing a replication cost*," which is incorrect for the reasons discussed above relative to claim 2.

The Office Action refers to Ye at col. 7, lines 49-52, as teaching "*solving the general integer program which provides a lower bound for the replication cost*," which is incorrect for the reasons discussed above relative to claim 2.

The Office Action refers to Ye at col. 9, lines 44-49, as teaching "*solving the specific integer programs which provides the replication cost for each of the replication classes*," which is incorrect for the reasons discussed above relative to claim 2 where the similar claim 2 limitation of "*solving the specific integer program which provides a specific lower bound for the replication cost*" is discussed.

The Office Action refers to Ye at col. 15, lines 50-64, as teaching "*selecting a particular heuristic class correlated to a low replication cost if a difference between the lower bound and the low replication cost is within an allowable amount*," which is incorrect for the reasons discussed above relative to claim 2 where the similar claim 2 limitation of "*selecting the heuristic class if a difference between the general lower bound and the specific lower bound is within an allowable limit*" is discussed.

To anticipate a claim, a prior art reference must teach each and every limitation of the claim. Not only does Ye not teach each and every limitation of claim 24, Ye fails to teach many of the limitations of claim 24. Accordingly, Claim 24 is allowable and an early allowance would be greatly appreciated.

Claims 25-27:

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Claim 25-27 were rejected as anticipated by U.S. Patent No. 6,374,227 to Ye, which is respectfully traversed.

Claims 25, 26, and 27 are claims drawn to a computer readable memory comprising computer code for implementing the methods of claims 1, 2, and 24, respectively. Claims 25, 26, and 27 recite the limitations of claims 1, 2, and 24, respectively. Accordingly, since Ye does not anticipate claims 1, 2, and 24, claims 25-27 are also not anticipated by Ye. Accordingly, claim 25-27 are allowable and an early allowance would be greatly appreciated.

Claim Rejections under 35 U.S.C. § 103:

Claims 6-10 and 15-23 were rejected under 35 U.S.C. § 103(a) as being obvious. Claims 6-10 were rejected as obvious over U.S. Patent No. 6,374,227 to Ye in view of U.S. Patent Publication No. 2002/0177989 by Alvarez et al. Claims 15-17 were rejected as obvious over U.S. Patent No. 6,374,227 to Ye in view of *Adaptive file allocation in distributed computer systems* by Mahmood et al. Claims 18 and 19 were rejected as obvious over U.S. Patent No. 6,374,227 to Ye in view of *Reuseable Strategies for Testing Safety-Critical Systems* by Poonawala. Claims 20-23 were rejected as obvious over U.S. Patent No. 6,374,227 to Ye in view of U.S. Patent Publication No. 2002/0184555 by Wong et al. The rejection of claims 6-10 and 15-23 is respectfully traversed.

Claims 6-10:

Claims 6-10 were rejected as obvious over U.S. Patent No. 6,374,227 to Ye in view of U.S. Patent Publication No. 2002/0177989 by Alvarez et al., which is respectfully traversed.

In the interest of brevity, the Office Action assertions regarding claims 6-10 are not being individually addressed here. Rather, Applicant asserts that claims 6-10 are dependent upon independent claim 2. Dependent claims include all of the limitation of the claim upon which they depend. The Office Action rejection of claims 6-10 refers to Ye as teaching the limitations of claim 2, which is incorrect. As explained above, Ye does not teach many of the limitations of claim 2. Therefore, Ye does not teach many of the limitations of each of claims 6-10. Assuming for the sake of argument that there was a motivation or suggestion to combine Ye and Alvarez et al., such a combination would

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not teach or suggest these differences. Accordingly, claims 6-10 are allowable over Ye in view of Alvarez et al. and an allowance at an early date would be greatly appreciated.

Claims 15-17:

Claims 15-17 were rejected as obvious over U.S. Patent No. 6,374,227 to Ye in view of *Adaptive file allocation in distributed computer systems* by Mahmood et al., which is respectfully traversed.

In the interest of brevity, the Office Action assertions regarding claims 15-17 are not being individually addressed here. Rather, Applicant asserts that claims 15-17 are dependent upon independent claim 2. Dependent claims include all of the limitation of the claim upon which they depend. The Office Action rejection of claims 15-17 refers to Ye as teaching the limitations of claim 2, which is incorrect. As explained above, Ye does not teach many of the limitations of claim 2. Therefore, Ye does not teach many of the limitations of each of claims 15-17. Assuming for the sake of argument that there was a motivation or suggestion to combine Ye and Alvarez et al., such a combination would not teach or suggest these differences. Accordingly, claims 15-17 are allowable over Ye in view of Alvarez et al. and an allowance at an early date would be greatly appreciated.

Claims 18 and 19:

Claims 18 and 19 were rejected as obvious over U.S. Patent No. 6,374,227 to Ye in view of *Reuseable Strategies for Testing Safety-Critical Systems* by Poonawala, which is respectfully traversed.

In the interest of brevity, the Office Action assertions regarding claims 18 and 19 are not being individually addressed here. Rather, Applicant asserts that claims 18 and 19 are dependent upon independent claim 2. Dependent claims include all of the limitation of the claim upon which they depend. The Office Action rejection of claims 18 and 19 refers to Ye as teaching the limitations of claim 2, which is incorrect. As explained above, Ye does not teach many of the limitations of claim 2. Therefore, Ye does not teach many of the limitations of each of claims 18 and 19. Assuming for the sake of argument that there was a motivation or suggestion to combine Ye and Alvarez et al., such a combination would not teach or suggest these differences. Accordingly,

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claims 18 and 19 are allowable over Ye in view of Alvarez et al. and an allowance at an early date would be greatly appreciated.

Claims 20-23:

Claims 20-23 were rejected as obvious over U.S. Patent No. 6,374,227 to Ye in view of U.S. Patent Publication No. 2002/0184555 by Wong et al., which is respectfully traversed.

In the interest of brevity, the Office Action assertions regarding claims 20-23 are not being individually addressed here. Rather, Applicant asserts that claims 20-23 are dependent upon independent claim 2. Dependent claims include all of the limitation of the claim upon which they depend. The Office Action rejection of claims 20-23 refers to Ye as teaching the limitations of claim 2, which is incorrect. As explained above, Ye does not teach many of the limitations of claim 2. Therefore, Ye does not teach many of the limitations of each of claims 20-23. Assuming for the sake of argument that there was a motivation or suggestion to combine Ye and Alvarez et al., such a combination would not teach or suggest these differences. Accordingly, claims 20-23 are allowable over Ye in view of Alvarez et al. and an allowance at an early date would be greatly appreciated.

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Conclusion:

In view of the above, the Applicant submits that all of the pending claims are now allowable. Allowance at an early date would be greatly appreciated. Should any outstanding issues remain, the Examiner is encouraged to contact the undersigned at (408) 293-9000 so that any such issues can be expeditiously resolved.

Respectfully Submitted,

Dated: March 13, 2006

Derek J. Westberg (Reg. No. 40,872)

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